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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/696,343

10/29/2003

Bruce Matthew Dunham

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8076

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04/18/2005

Patrick Rasche
Armstrong Teasdale LLP
Suite 2600
One Metropolitan Square
St. Louis, MO 63102

EXAMINER

KIKNADZE, IRAKLI

ART UNIT

PAPER NUMBER

2882

DATE MAILED: 04/18/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/696,343

Applicant(s)

DUNHAM ET AL.

Examiner

Irakli Kiknadze

Art Unit

2882

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-5 is/are allowed.
- 6) ☒ Claim(s) 6, 7, 12-16 and 19-22 is/are rejected.
- 7) ☒ Claim(s) 8-10, 17 and 18 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 10/29/2005.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this

Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 6, 7, 12, 21 and 22 are rejected under 35 U.S.C. 102(b) as being anticipated by Gard et al. (US Patent 5,550,889).

With respect to claim 6, Gard teaches a method for adjusting a focal spot position during a scan of a computed tomography imaging system having a z-axis, wherein the computed tomography imaging system includes a detector array (16) having a plurality of detector elements (18) and an x-ray tube (13) configured to direct an x-ray beam (14) towards the detector through an object (15) to be imaged, the method comprising: reading a temperature of the x-ray tube; obtaining calibration data for a focal spot position of the x-ray tube; utilizing the tube temperature and calibration data to determine voltages to be applied to a cathode of the x-ray tube; and applying the determined voltage to the cathode of the x-ray tube (column 4, lines 1-30).

With respect to claim 7, Gard teaches a “third generation” CT scanner comprising the x-ray tube (13) comprising a collimator preset in a default position that projects beam of x-rays toward a detector array (16) (column 2, lines 43-47).

With respect to claim 12, Gard teaches a computed tomography imaging system comprising: a detector array (16) having a plurality of detector elements (18); an x-ray tube (13) configured to direct an x-ray beam (14) towards the detector array (16) through an object (15) to be imaged; wherein the x-ray tube (13) and detector array (16) are on a gantry (12) defining a z-axis (Fig.2; column 2, lines 44-56), and wherein the computed tomography system is configured to electronically adjust a focal spot of the x-ray tube in a z-axis direction to perform z-axis tracking (Fig.3; column 4, lines 62-67).

With respect to claim 21, Gard teaches a computed tomography imaging system comprising: a detector array (16) having a plurality of detector elements (18); and an x-ray tube (16) configured to direct an x-ray beam (14) towards the detector array (16) through an object (15) to be imaged; wherein the detector array (16) and the x-ray tube (13) are on a gantry (12) defining a z-axis, and the computed tomography system is configured to determine a temperature of the x-ray tube (13) and to electronically adjust a focal spot of the x-ray tube in a z-axis direction in accordance with at least the determined temperature to perform z-axis tracking (Column 4, lines 11-29).

With respect to claim 22, Gard teaches adjusting the focal spot position in accordance with a speed of said gantry, tilt, and x-ray tube position (column 4, lines 52-61).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis

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for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claim 11 is rejected under 35 U.S.C. 102(b) as being anticipated by Gard et al. (US Patent 5,550,889) in view of Toth (US Patent 6,866, 419).

With respect to claim 11, Gard teaches claimed invention except that the imaging system has coverage between 20 to 200 mm at isocenter. Toth teaches that it is known to obtain and compensate z-position error in a computed tomography imaging system having coverage about 100 mm at isocenter (column 5, lines 50-54). It would have been obvious to one of ordinary skill in art at the time the invention was made to employ the CT system coverage teachings of Toth in the invention of Gard to provide the imaging system having a coverage between 20 to 200 mm at isocenter, since it has been held that where the general conditions of a claim are disclosed in the art, discovering working range involves only routine skill in art.

5. Claims 12-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Toth et al. (US Patent 6,411,677 B1) in view of Hell et al. (US Patent 6,178,226 B1).

With respect to claim 12, Toth teaches a computed tomography imaging system comprising: a detector array (18) having a plurality of detector elements (20); an x-ray tube (14) configured to direct an x-ray beam (16) towards the detector array (18) through an object (22) to be imaged; wherein the x-ray tube

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(14) and detector array (18) are on a gantry (12) defining a z-axis, and wherein the computed tomography system is configured to adjust a focal spot of the x-ray tube (14) in a z-axis direction to perform z-axis tracking by some amount by means of a collimator (52). The detector array includes z-channel detectors (62,64,66 and 68) for determining a Z-axis position of x-ray beam (column 2, lines 36-50; column 3, lines 9-24 and column 7, lines 46-55). Toth is silent about electronically adjusting a focal spot. Hell teaches an X-ray tube having a vacuum housing (1) and comprising a continuously heated electron emitter arranged at the cathode side (2), a focusing electrode (3), deflection system (6) and a control unit (10) comprising adjustment elements for electronically adjust a focal spot (BF) of the X-ray tube (column 4, lines 17-45). It is possible to adjust the size of the focal spot (BF) on an anode (4) by means of the potential at the focusing electrode (3) by adjusting a focusing voltage (column 5, lines 14-24). The potential at the focusing electrode (3) influences the diameter D of the electron beam (5) and thus the size of the focal spot (BF) irradiating X-rays in a z-axis direction. Accordingly, the focal spot size controlling/tracking would provide z-axis tracking. It would have been obvious to one of ordinary skill in art at the time the invention was made to employ the focal spot size controlling teachings of Hell in the CT imaging system of Toth to provide enhanced z-axis tracking utilizing a combination of electronic focal spot adjustment and mechanical collimator adjustment suitable for computed tomography systems having large coverage at isocenter because it would furthermore manage "focal spot wobble" which improves image quality without complicated and costly z-axis tracking single

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collimator system.

With respect to claim 13, Toth teaches that the detector array includes z-channel elements and an X-ray controller (28) to control the collimator (50) adjusting a focal spot of the x-ray tube in a z-axis direction to perform z-axis tracking (column 3, lines 9-24). Toth is silent about adjusting a voltage applied to the x-ray tube cathode. Hell teaches adjusting a voltage applied to the x-ray tube cathode for adjusting the size of the focal spot (BF) (column 4, lines 42-44; column 5, lines 13-24 and 52-62; column 6, lines 13-23). The focal spot size controlling/tracking would provide z-axis tracking. It would have been obvious to one of ordinary skill in art at the time the invention was made to employ the focal spot size controlling teachings of Hell in the CT imaging system of Toth to provide z-axis tracking utilizing a combination of electronic focal spot adjustment by adjusting the voltage to the X-ray tube cathode and mechanical collimator adjustment because it would furthermore manage "focal spot wobble" therefore improve image quality without complicated and costly single z-axis tracking collimator system.

With respect to claim 14, Hell teaches that the system is configured to maintain the focal spot (50) at a position constant in the z-axis direction relative to a casing of the x-ray tube and the detector (18) (column 3, lines 9-12).

With respect to claim 15, Toth teaches that the x-ray collimator (52) is set to a predetermined initial position to collimate the x-ray beam in accordance with a specified slice thickness (column 3, lines 29-37).

With respect to claim 16, Toth teaches that the system is configured to

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determine a shift in focal spot position in accordance with z-ratio read from the detector (18) (column 3, lines 9-37).

6. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Toth et al. and Hell et al. (US Patent 6,178,226 B1) as applied to claim 12 above, and further in view of Zastrow et al. (US Patent 6,424,697 B1).

With respect to claim 19, Toth as modified by Hell teaches that the detector (18) defines an x-direction and the detector is curved in the x-direction (Fig. 2) but fails to specify that the collimator (52) having collimator blades curved substantially in proportion to the curvature of the detector (18) in the x-direction. Zastrow teaches a comparable CT imaging system comprising a collimator (56) having collimator blades curved substantially in proportion to the curvature of a detector (18) in the x-direction (column 5, lines 7-10) so that magnification is constant across the detector (18). It would have been obvious to one of ordinary skill in art at the time the invention was made to employ the curved collimator teachings of Zastrow in the CT imaging system of Toth as modified by Hell to provide the X-ray beam with a wide range between closed and wide position with constant magnification across the detector (18) because it would simplify reconstruction of an image.

7. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Toth et al. and Hell et al. as applied to claim 12 above, and further in and further in view of Gard et al. (US Patent 5,550,889).

With respect to claim 20, Toth as modified by Hell teaches that the detector array includes z-channel elements, and to adjust a focal spot of the x-

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ray tube in a z-axis direction to perform z-axis tracking but fails to teach the x-ray tube comprises a coil to adjust a focal spot. Gard teaches an X-ray CT system comprising the x-ray tube comprising a coil (41) to adjust a focal spot of the x-ray tube in a z-axis direction by adjusting a current applied to the coil (41) (Fig.3; column 4, lines 62-68). It would have been obvious to one of ordinary skill in art at the time the invention was made to employ the deflection coil teachings of Gard in the CT system of Toth as modified by Hell to provide enhanced z-axis tracking utilizing a combination of electronic focal spot adjustment and mechanical collimator adjustment suitable for computed tomography systems having large coverage at isocenter because it would precisely control "focal spot wobble" which improves image quality without complicated and costly z-axis tracking single collimator system.

Allowable Subject Matter

8. Claims 8-10, 17 and 18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

9. Claims 1-5 are allowed.

10. The following is a statement of reasons for the indication of allowable subject matter:

With respect tot claims 1-5 prior art fails to teach or make obvious a method for adjusting a focal spot position during a scan of a computed tomography imaging system having a z-axis, the method comprising: using a

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transfer function to determine an electronic deflection value; and applying the electronic deflection value to the x-ray tube as at least one of a deflection voltage or a deflection current to track the focal spot in the z-axis direction as claimed in claim 1.

With respect tot claims 8-10 prior art fails to teach or make obvious a method for adjusting a focal spot position during a scan of a computed tomography imaging system having a z-axis comprising obtaining a transfer function for focal spot position in accordance with x-ray tube temperature as claimed in claim 8.

With respect tot claim 17-20 prior art fails to teach or make obvious a CT imaging system configured to utilize transfer function to determine a cathode bias voltage for the x-ray tube to compensate for the focal spot position shift as claimed in claim 17.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Buchmann (US Patent 6,104,871) teaches an X-ray source comprising a focal spot corresponding to the specific modulation transfer function.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Irakli Kiknadze whose telephone number is 571-272-2493. The examiner can normally be reached on 9:00- 5:30.

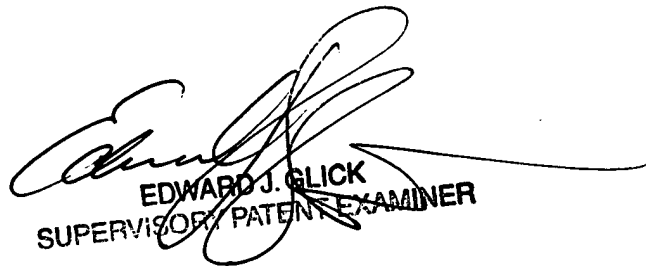
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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ed Glick can be reached on 571-272-2490. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Irakli Kiknadze
April 12, 2005

IK


EDWARD J. GLICK
SUPERVISOR, PATENT EXAMINER